Lat 40.28573 Lon -121.23194

Forest Health Protection

Pacific Southwest Region

Date: September 11, 2002
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To: District Ranger, Almanor Ranger District, Lassen National Forest

Subject: Evaluation of Lodgepole Pine Mortality (FHP Report NE02-09)

At the request of Russ Volke, Silviculturist, I conducted a field evaluation of the Forest Service parcel, known as the First Avenue area, adjacent to the airport in Chester (Plumas County) on July 24, 2002. The objective of my visit was to identify the cause of the lodgepole pine (*Pinus contorta var. murrayana*) mortality that has occurred over the last year and provide management recommendations as appropriate.

Background

The First Avenue parcel is located along the west shore of Lake Almanor at an elevation of 4500 feet and is considered bald eagle foraging and roosting habitat due to its proximity to the lake and nearby nesting sites. This shore of the lake is particularly shallow creating a gradual wetland, meadow, and forest transition. Precipitation averages 30 - 35 inches per year. The forested area is occupied by a mix of Jeffrey pine (*Pinus jeffreyi*), ponderosa pine (*Pinus ponderosa*) and lodgepole pine with a few small pockets of mixed conifer that include sugar pine (*Pinus lambertiana*), incense cedar (*Libocedrus decurrens*) and white fir (*Abies concolor*). Jeffrey pine and ponderosa pine are dominant to co-dominant in the overstory with lodgepole pine. The understory is made up of dense lodgepole pine with lesser amounts of Jeffrey pine, ponderosa pine and white fir. The stand is overstocked at roughly twice the recommended level for the site

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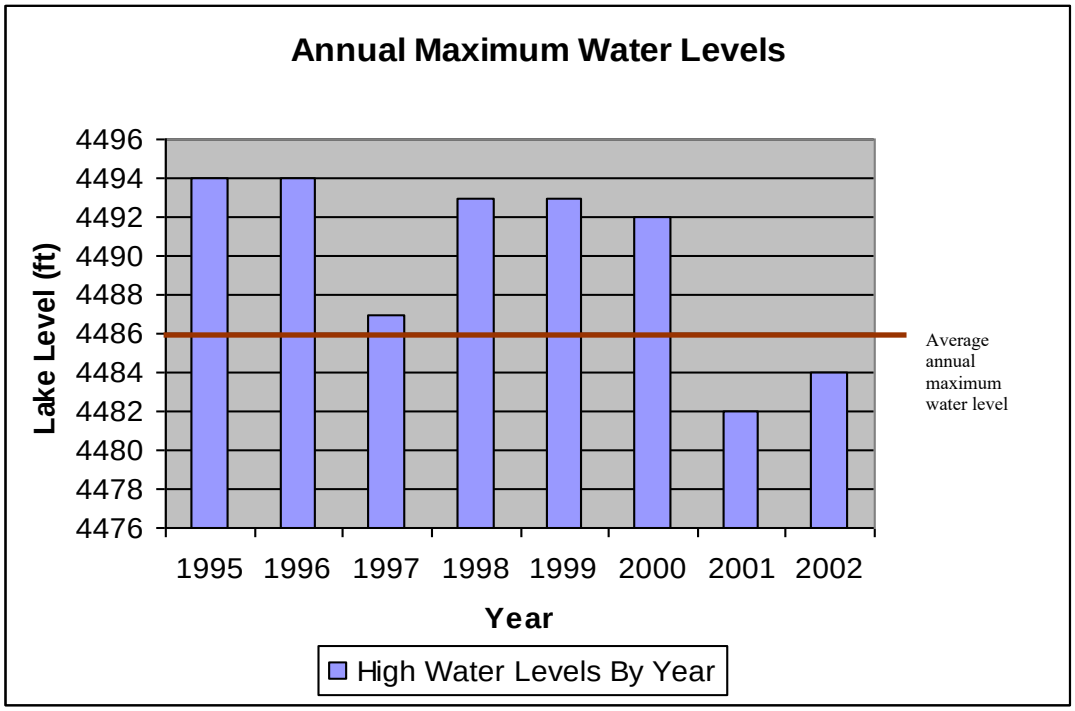
(approximately 100 – 150 BA) on average.

Due to its proximity to Lake Almanor, a reservoir with periodic water level fluctuations, the area experiences a highly variable water table. For example, the average water level in the lake was well above normal from 1995 to 2000, but was well below normal in 2001 (Table 1).

Resource use in this area is primarily fuelwood cutting of dead trees and has resulted in the build up of smaller diameter material such as tops and limbs. This material combined with the dense understory of lodgepole pine has created high concentrations of surface and ladder fuels. These fuels are of particular concern as this area is adjacent to the community of Chester, the airport, and is within the defense zone of the designated wildland urban interface.

Table 1. Lake Almanor water levels (1995-2002)

*Annual maximum water levels are typically recorded in June and remain high through August.



Observations

The mortality observed was mostly lodgepole pine of all age classes with the larger trees most affected. The primary cause of this mortality seems to be water stress as there was no evidence of mountain pine beetle (*Dendroctonus ponderosae*) infestation in any of the trees inspected. Most trees were occupied only by flatheaded and/or roundheaded wood boring beetles (Appendix A). Most of the mortality has occurred within areas where current stocking levels meet or exceed those appropriate for the site. Other factors that may have contributed to the lodgepole mortality were animal damage, consisting of bark removed from tree boles, and widespread infection by western gall rust (*Peridermium harknessii*) (Appendix A). It was determined that Douglas squirrels (*Tamiasciurus douglasii*) inflicted the bole damage by peeling

bark and feeding on tree phloem over the past two winters. Patches of stripped bark in the upper boles of mid to overstory trees was evident in approximately 30% of the stand. In some cases trees were completely girdled. Western gall rust was found on stems and branches of all size classes of lodgepole, either in the form of galls or cankers.

Very little mortality was observed in Jeffrey pine or ponderosa pine. Closer inspection of the few dead trees revealed only woodborers except for one pocket of ponderosa pine that were attacked and killed by western pine beetle (*Dendroctonus brevicomis*) (Appendix A). Again, the underlying cause of mortality was most likely water stress. Most mortality was found in stands that meet or exceed fully stocked conditions for the site.

The amount of fuel that has built up within the stand is considerable and will increase as mortality continues. Fuelwood cutters typically do not remove smaller diameter dead trees and the larger diameter dead trees that they do remove contribute a considerable amount of slash from the tops and limbs left behind.

Discussion

The water stress that is occurring in trees on this site is due to several factors; high stand density, ongoing drought conditions, and potentially, water table changes created by the fluctuating lake levels. The stand is currently in an overstocked condition with the exception of a few small areas of open growing mature pine. Overstocking has resulted in excessive competition among trees for the limited moisture available during the current dry spell. In addition, six years of high water in the lake created saturated soils during the growing seasons that may have resulted in significant root damage. As a result, some trees may have not been able to obtain enough water when the lake level rapidly dropped in 2001 (Table 1).

The potentially extreme water level fluctuations of Lake Almanor make it critical that forested portions of the First Avenue area are maintained in as healthy a condition as possible. Inhibited root growth or even root dieback can occur with extended periods of high water during the growing season. Damage occurs when flooded and saturated soils reduce the supply of oxygen to the roots. This root damage exacerbates the potential for water stress and tree mortality when lake levels drop during subsequent dry periods. Tree species with shallow root systems, such as lodgepole pine, are at an even greater risk of mortality under these conditions. Even under more natural soil moisture regimes, the current overstocked condition of the stand would make it highly susceptible to water stress and bark beetle related mortality during periods of drought.

The presence of mature ponderosa, Jeffrey, and lodgepole pine throughout the stand is evidence that trees can grow well in the First Avenue area despite unnatural soil moisture conditions. The water table event, five years of high water followed by a dramatic one-year decrease, is not unprecedented. A review of historic water level fluctuations for Lake Almanor shows that these stands have experienced similar extremes in the past. The current mortality levels, therefore, are more a reflection of a combination of factors such as high stand density, fluctuating water levels and drought rather than fluctuating water levels alone.

To date, bark beetle related mortality has been limited within the First Avenue area. In northeastern California, conifer mortality resulting from bark and engraver beetles was at

relatively low levels up until last year. Since then, bark and engraver beetle related mortality has been steadily increasing and is expected to continue until the current period of below normal precipitation ends. If stands in the First Avenue area remain in their current overstocked condition, future mortality from bark and engraver beetles can be expected. In addition, if mortality occurs in the large overstory pines, the suitability of the habitat for bald eagles will be reduced.

Animal damage, caused by Douglas squirrel feeding, only occurred over the past two winters. It is suspected that this damage is related to the lack of a significant cone crop for both of these years. Douglas squirrels typically store large quantities of cones for use in winter. Since cones were not abundant, squirrels began to feed on the phloem and sapwood of selected trees as their relatively small caches were depleted. With the large cone crop observed this year further damage is not expected. Trees that had large amounts of bark stripped from their boles are at a higher risk of mortality than unaffected trees during drought conditions.

Conclusion

In order to improve stand health and vigor, trees should be thinned to a basal area appropriate for the site (100 – 150 BA). To reduce the susceptibility to future bark beetle related mortality, stands should be thinned to densities that are 80% or less of "normal". When planning such thinning, it should be recognized that this is an average to be applied across the landscape and some variability may be desired. Individual high value trees, such as mature pine, as well as pure stands of younger ponderosa and Jeffrey pine should benefit by having the stocking around them reduced to lower levels. When selecting trees for removal preference should be given to trees infected with western gall rust, trees infested with bark beetles and trees with extensive animal damage. In addition Jeffrey pine and ponderosa pine should be retained over lodgepole pine when tree spacing is a concern. Both of these species appear to be in far better health and, due to their deeper rooting habits, are more suitable to this unique site than lodgepole pine.

Thinning of the First Avenue area would maintain and enhance bald eagle habitat by protecting existing large diameter trees and accelerating the development of additional large trees for future roosting and nesting.

In addition to reducing tree stress, thinning and fuels treatment, especially of the understory, will somewhat reduce the risks and damage from any fire that might occur and provide a more defensible space for the community of Chester.

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Forest Health Protection is currently assisting with the development of a proposal for the funding of a bark beetle prevention project, which includes thinning and removal of material from overstocked stands, in the First Avenue Area. If you have any questions regarding this report, the proposal for funding, and/or need additional information please contact me at 530-252-6431 or at dcluck@fs.fed.us.

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Appendix A – Biology of detected insects and diseases

Western Pine Beetle

The western pine beetle, *Dendroctonus brevicomis*, has been intensively studied and has proven to be an important factor in the ecology and management of ponderosa pine throughout its range. This insect breeds in the main bole of living ponderosa pine larger than about 4 inches in diameter. Normally it breeds in trees weakened by drought, overstocking, root disease, dwarf mistletoe or fire. Adult beetles emerge and attack trees continuously from spring through fall. Depending on the latitude and elevation, there can be from one to four generations per year.

The availability of suitable host material is a key condition influencing western pine beetle outbreaks. Under normal conditions the western pine beetle breeds in old or unhealthy trees, as well as those weakened by drought, overstocked stand conditions, or fires. In California, drought stress may be the key condition influencing outbreaks in that healthy trees undergoing sudden and severe moisture stress facilitate the buildup of western pine beetle populations. Healthy trees ordinarily produce abundant amounts of resin, which pitch out or eject attacking beetles. However, when deprived of moisture, stressed trees cannot produce sufficient resin flow to resist attack. Any condition that results in excessive demand for moisture, such as tree crowding, competing vegetation or protracted drought periods; or any condition that reduces that ability of the roots to supply water to the tree, such as mechanical damage, root disease, or soil compaction, can cause moisture stress and increase susceptibility to attack by the western pine beetle.

Flatheaded and Roundheaded wood boring beetles

There are many species of wood boring beetles and most only infest weakened or dead trees. The adults, in contrast to the bark beetles, do not mine under the bark. They lay eggs on the bark of trees that have been severely weakened or killed by bark beetles, pathogens, fire, drought, and/or injury. Large, white, legless larvae mine under the bark, producing course white boring dust and long wood fibers, and eventually move into the sapwood. Pupation occurs in the wood, cambium, or inner bark, depending on the species. Some species have a one-year life cycle with habits similar to bark beetles. Others can take several years to develop from egg to adult.

Western Gall Rust

Western gall rust, *Peridermium harknessii,* occurs in most species of pine and is widespread throughout the west. The formation of globose to pear-shaped galls as large as 12 inches in diameter on branches and stems of pine of all ages characterize the disease. Trunk or “hip” cankers are common. Spores produced by the galls and hip cankers are wind disseminated and can spread the disease for hundreds of miles directly infecting other pines. Moist conditions favor infection of young pine tissue by the germinating spores. The damaged caused by this disease includes (1) killing of seedlings, (2) production of branch galls so numerous that larger trees are killed outright or their growth is diminished by loss of branches, and (3) production of trunk cankers so deforming that they reduce the strength of the tree and increase the likelihood of wind breakage.

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